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A PRELIMINARY ANALYSIS OF THE STATUS OF THE TILEFISH POPULATION IN THE SOUTHERN NEW ENGLAND-MIDDLE ATLANTIC REGION

by

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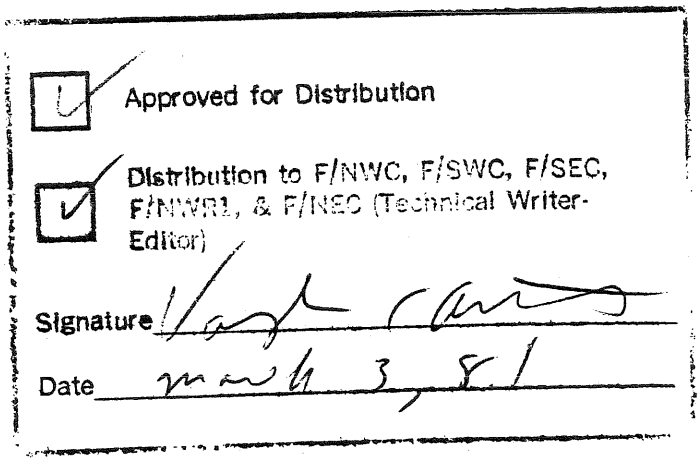

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INTRODUCTION

A domestic commercial longline fishery for tilefish (Lopholatilus chamaeleonticeps) has developed in recent years in the area between Cape Hatteras and Cape Cod, with catches (herein considered equivalent to landings), increasing from about 30 metric tons (t) in 1968-69 to approximately 3,800 t in 1979. Concerned with the effect of this developing fishery on the resource, the Mid-Atlantic Fishery Management Council is developing a Fishery Management Plan (FMP) for tilefish north of Cape Hatteras. Little is known of the biology of this species, and only limited fishery statistics are available for assessing the status of this resource. The purpose of this paper is to review the available biological data and fishery statistics and to offer some general comments and conclusions concerning the current status of the tilefish population in the Southern New England-Middle Atlantic region.

BIOLOGY

Tilefish occur along the outer continental shelf from Nova Scotia to Surinam (South America) in depths of 80 to 540 m (Dooley 1978). They are abundant in 1) the Southern New England-Middle Atlantic area, where a commercial fishery has existed since 1915; 2) off southeastern Florida where a small fishery remains active; and 3) possibly in the Gulf of Mexico, where recent commercial activity indicates that a limited fishery could develop (Grimes et al. 1980).

In the Southern New England-Middle Atlantic area tilefish generally occur at depths of 80 to 440 m and at temperatures of 9° to 14.5°C (Freeman and Turner 1977). Fish have been observed from Norfolk (Grimes and Able[3]) to Lydonia Canyons (Cooper and Uzmann[4]) (Fig. 1). The limited amount of area between the appropriate isobaths south of the Hudson Canyon region precludes the existence of large concentrations of tilefish.

Tilefish have been observed occupying burrows (Grimes et al. 1980, Cooper and Uzmann, see footnote 4) as well as depressions near boulders and obstructions (Valentine et al. 1980). Burrows are found in Pleistocene clay and generally located vertically with respect to the bottom (Grimes et al. 1980, Cooper and Uzmann, see footnote 4), although horizontal burrows have been observed in the walls of submarine canyons (Warme et al. 1977). Large concentrations of other organisms, especially crabs, occur in the areas immediately adjacent to some of these large excavations, indicating that they are focal points of biological activity (Grimes et al. 1980). East of Atlantis Canyon tilefish have been observed in boulder fields having non-clay substrates where they use large objects and associated depressions for shelter (Valentine et al. 1980, Cooper and Uzmann, see footnote 4).

Tilefish are relatively slow growing compared to species such as cod and haddock. Growth increments of approximately 10 cm each year for the

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[3]Churchill B. Grimes and Kenneth W. Able, Rutgers University, New Brunswick, NJ, personal communication.

[4]Richard A. Cooper and Joseph R. Uzmann, NMFS, NEFC, Woods Hole Laboratory, Woods Hole, MA, personal communication.

first five years are usual. Females mature at about age 6 (55-60 cm in fork length or 2.4-3.2 kg in weight) and after maturation exhibit slower growth than the males. Preliminary data indicate that males mature at about age 8-9 (65-70 cm or 4.1-5.2 kg). Females reach approximately 85 cm (9.8 kg) at age 20, while males average 96 cm (14.5 kg) at that same age (Grimes et al. 1980). Maximum observed age is 29 years for males and 33 years for females; maximum observed fork length is 112 cm for males and 95 cm for females (Turner et al. in press). The different growth rates of males and females after age 5 results in skewed sex ratios at larger sizes (Grimes et al. 1980).

Little else is known about the reproductive biology of tilefish. Morse (1981) concluded from examinations of 14 tilefish that repeat spawning occurred from March to August, and that fecundity increased with size, ranging from 5×10^5 to 1×10^6 eggs per kg of body weight. Freeman and Turner (1977) observed ripe tilefish from mid-March to mid-September, and Grimes et al. (1980) found gravid females from late May through September. Tilefish eggs are apparently buoyant (Freeman and Turner 1977) with the resulting larvae being pelagic (Berrien in press).

The movement patterns of tilefish are poorly understood, although results from a preliminary in situ tagging study suggest that tilefish do not migrate long distances (Grimes et al. 1980). Freeman and Turner (1977) reported local movements of 1-2 miles a day.

Stock separation studies show that genetic differences exist between L. chamaeleonticeps in the Middle Atlantic and in the South Atlantic Bight and Gulf of Mexico. Morphometric data indicate a gradual variation in

some characters over the range of the species. Two genetically separate stocks have been suggested (Katz et al. 1979, Grimes et al. 1980).

Tilefish feed primarily on crustaceans and a variety of other prey items including echinoderms, bivalves, polychaetes, squid, and fish. While small tilefish (<50 cm) rely on crustaceans and a variety of benthic invertebrates, a transition is noted at larger sizes to a diet characterized by a greater dependence on crabs and shrimp, with fish and squid predominant among the secondary prey items (Turner and Freeman[5], Dooley 1978).

HISTORY OF THE FISHERY

Commercial Fishery

Commercial catches of tilefish were first recorded in 1915 when 148 t were taken following an extensive campaign by the U.S. Fish Commission to develop a fishery (Smith 1917). A catch of 4,500 t (the largest ever) was reported in 1916 (Smith 1917, 1919), followed by a sharp decline to only 5 t in 1920 (Figure 2). Prior to 1940, catch information reported herein is complete for all states in the Southern New England - Middle Atlantic area only for 1915, 1929, 1935, and 1937-39. Very little or no data exists for 1920 and 1934. Since 1920, the fishery has gone through several cycles wherein catches have steadily increased to a peak and then declined.

From a reported level of 5 t in 1920, catches increased to about 2,100 t in 1929 and then dropped to zero in 1941 (Table 1). During this period, New York accounted for most of the catch, while Massachusetts and Rhode Island were the only other states recording significant amounts. Catches

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[5]Turner, S.C. and B.L. Freeman. The food of tilefish, Lopholatilus chamaeleonticeps, in the Middle Atlantic, manuscript.

remained very low during the early 1940's because of World War II, but began increasing again in the late 1940's, with New York again accounting for most of the catch. During the 1950's, Massachusetts and Rhode Island contributed the bulk of the catch. After reaching a level of about 1,500 t in 1954-55, catches fluctuated considerably during the next 10 years while undergoing a pronounced decline to about 30 t in 1968-69. During the 1960's, Rhode Island generally accounted for the greatest catch by any state in most years. Catches began increasing again in the early 1970's, reaching a level of over 3,800 t in 1979. During this latest increase, New Jersey has been the principal state reporting catches.

Longlines were the predominant gear used until the early 1940's, after which trawling became the predominant method until the early 1970's. Since 1972, longlines have taken the majority of the catch (Freeman and Turner 1977) although some catches continue to be taken by bottom trawls.

The tilefish fishery has been conducted almost exclusively by U.S. vessels. Ireland, Japan, and Spain are the only other countries which have reported tilefish catches, these occurring in 1972 and 1975-78 and never exceeding 12 t in any year. It is possible, though, that some tilefish were caught by distant-water fleets during the 1960's and 1970's and simply reported as other finfish.

Information from the NMFS Foreign Fisheries Observer Program since 1977 indicates that tilefish have been taken as by-catch in the distant-water-fleet fisheries for silver hake, red hake, and squid. Since tilefish is one of the prohibited species in the foreign fishery, any catch must be discarded. Observers recorded tilefish catches of 29 t

in 1978 and 12 t in 1979 while monitoring about 20 and 24%, respectively, of the fishing activity (days fished) in those years. If catch rates were comparable during the non-monitored fishing activity, total tilefish catches from distant-water-fleet fisheries would have been about 150 t in 1978 and 50 t in 1979.

Recreational Fishery

A recreational fishery for tilefish developed in the Mid-Atlantic area in 1968, and party-, charter-, and private-boat activity was high during the early and mid-1970's. Since 1968, annual catches are estimated to have ranged from 5 to 340 t (Freeman and Turner, in press). The recreational catch in New Jersey between July 1973 and June 1974 was estimated from a telephone survey to be 242 t (Deuel[6]).

Recreational effort was greatly reduced by 1978 due to increased fuel costs, decreased size and availability of tilefish, and concomitant reduced interest by the recreational community. Grimes et al. (in press) reported that approximately 12 party-boat trips were made from New Jersey ports in 1978 with combined catches estimated at about 4-5 t. The number of trips by New Jersey party-boats has since continued to decline. A few party-boat trips may have been made in the spring of 1980, but none were made in the fall. Results from the NMFS Marine Recreational Fishery Statistics Survey indicated no recreational catch of tilefish north of Cape Hatteras in 1979 (Deuel, see footnote 6).

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[6]David G. Deuel, NMFS, Resource Statistics Division, Washington, DC, personal communication.

CURRENT COMMERCIAL FISHERY

Catch

A longline fishery for tilefish developed out of Barnegat Light, New Jersey in 1972 when 111 t were caught (Table 1). Since that time, the New Jersey catch has increased each year and has exceeded that of any other state while averaging nearly 70% of the total annually. Massachusetts ranked second to New Jersey in tilefish catches during 1973-76, averaging 21% of the catch each year; Rhode Island ranked second in 1977. In 1977, Montauk, New York assumed importance as a port for longline vessels fishing for tilefish. New York catches increased rapidly after 1977 and ranked next to New Jersey in 1978-79 averaging over 30% of the annual catch in those two years.

The total catch of tilefish increased from 30 t in 1968-69 to 3,840 t in 1979. The catches in 1978-79 were larger than in any other year except 1916. Fishing with longlines accounted for the majority of the catch between 1972 and 1979, although trawlers from Massachusetts and Rhode Island continued to bring in significant quantities especially in the winter and spring.

Effort

Since the renewal of the longline fishery in the early 1970's, the number of vessels has steadily increased. The fishery was initiated by charter- and party-boats which either were idle or set longlines inshore for cod during the winter months. Many of these vessels gradually switched

to fishing for tilefish during most or all of the year, and numerous other vessels also entered the fishery. Fleet size increased roughly from 5 to 25 boats between 1974 and 1978 (Grimes et al. in press). Approximately 30 vessels from New York and New Jersey fished longlines for tilefish in 1980. Additionally, a small number of longliners and trawlers have participated in the fishery out of ports ranging from Chatham, Massachusetts to Virginia Beach, Virginia.

The increase in the number of vessels fishing for tilefish has been accompanied by increases in the amount of effort per vessel. The amount of longline gear fished per trip by vessels from Barnegat Light, New Jersey increased about 150% between 1974 and 1978 (Grimes et al. in press). This was due to increases in both the length of trips and the amount of gear fished per trip. Fishermen report that the amount of gear fished per trip has continued to increase since 1978, although not as rapidly as in the previous 4 years. More gear has generally been fished per trip during the summer and fall than in the winter because of weather limitations in the winter and much lower catch rates in the summer.

Catch Per Unit Effort

Grimes et al. (in press) examined catch per unit effort (CPUE) (kg per hook) in the recent longline fishery by years, seasons, areas, and depths, and found statistically significant differences for seasons, areas, and the interaction of seasons and areas. During winter and spring, CPUE was consistently higher than in the summer.

CPUE increased from 0.6 kg/hook in 1974 to 1.0 kg/hook in 1975, decreased to 0.6 and 0.7 kg/hook in 1976 and 1977, respectively, and to 0.3 kg/hook in 1978 (Figure 3). Data since 1978 have not been analyzed; however, personal communications with fishermen in Barnegat Light and Montauk suggest that CPUE continued to decline in 1979 and 1980. Recent increases in the number of hooks fished per trip and the conversion of most vessels to automatic at-sea baiting equipment (which produces higher catch rates) is an indication of the efforts by fishermen to compensate for declining CPUE and/or increased trip costs.

Tilefish are rarely caught by the NMFS research vessel bottom trawl survey. The lack of catches by the survey gear, which is due to their propensity to hide in burrows (Grimes et al. 1980) or to seek the shelter of boulders or obstructions when frightened (Cooper and Uzmann, see footnote 4), has made it impossible to calculate a relative abundance index for tilefish from bottom trawl survey catches.

Catch Composition

The average size of the tilefish caught by longline between 1974 and 1978 declined with the catch rate. Length frequency histograms (Grimes et al. in press) for tilefish captured in various regions and time periods are shown in Figure 4. Data from two regions are examined because nearly all of the fishing in 1974 occurred in the Hudson Canyon region, whereas the fishing grounds were expanded between 1975 and 1977 to include areas north and east of Hudson Canyon. In the first period for each area, fish 90 cm and greater were fairly frequent, while in subsequent periods, these

sizes were far less common.

The modal length group in the catch declined from 76-80 cm (6.8-8.0 kg) in 1974 to 66-70 cm (4.3-5.2 kg) in 1978, while the frequency of fish measuring 51-55 cm (1.9-2.4 kg) increased. Dockside observations indicate that the decrease in average length continued in 1979 with one group of fish at 50-60 cm (2.0-3.5 kg) being quite abundant.

Age-length keys are currently not available to convert the length frequencies to age frequencies, although a limited perspective on changes in age structure is possible from preliminary aging. The modal size of 76-80 cm in 1974 was probably composed of fish older than age 10, while the modal size in 1978 represented fish of ages 8-10. The size group above 90 cm consisted of relatively old females and slightly younger males whose average ages were 15-20 years and older. The small fish (51-55 cm), which were relatively frequent in the 1978 catch, averaged about age 5.

As stated earlier, male tilefish mature at 65-70 cm and females at 55-60 cm. Approximately 15% of the fish in 1974 were below 60 cm; in 1975-77 and 1978, 10% and 30%, respectively, were below that size. Assuming that half of these fish were female, 8%, 5%, and 15% of the female tilefish were caught before maturation in 1974, 1975-77, and 1978, respectively. Similar estimates for male tilefish, while probably high because the more rapid growth of males may produce observable differences in length at age between 60 and 70 cm, are 10% immature in 1974, and 30-35% in both 1975-77 and 1978.

DISCUSSION AND CONCLUSION

Since the recent and rapid expansion of the longline fishery, catches in the Southern New England-Middle Atlantic area have increased from about 30 t (1968-69) to 3,840 t (1979). The number of vessels in the fishery has steadily increased from five in 1974 to approximately 30 operating from Barnegat Light, Cape May, and Sea Isle City, New Jersey and Montauk, New York in 1980. Most of these fish 9-12 months of the year, although a few are active only in the winter. A small number of additional vessels participates in the fishery from ports outside of the New Jersey-New York area.

Limited data from 1974-78 indicate that the amount of effort per vessel increased while CPUE decreased. The skill and information with which a fishermen operated in 1978 was probably higher than in 1974, thus increasing the effectiveness of a unit of effort. Thus, while a decrease in CPUE is evident, actual stock biomass, if it is proportional to CPUE, may have undergone an even greater decline.

While CPUE has been declining, the average size of the fish in the catch decreased and the percentage of immature fish in the catch increased.

Reduction in both catch rate and size of fish may be expected when an unexploited stock is initially harvested. Given the limited amount of data available, the precise implications and consequences of these reductions cannot be determined at the present time. However, the increasing trend in catch and effort coupled with a decline in CPUE and the average

size of the fish, is reason for concern. Continued collection of fishery statistics and sampling data is needed to develop a longer time-series of information. In addition, age data as well as growth parameters and a natural mortality rate must be developed and incorporated with the existing fishery statistics and sampling data to formulate a quantitative analysis of the size and structure of the tilefish stock and the effects of fishing on that resource.

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Table 1. Tilefish catch by states from 1940 to 1979. A dash (-) indicates data not available; a zero (0) indicates no catch made; an asterisk (*) indicates a catch of less than 0.5 t.

Year	MA	RI	CT	NY	NJ	VA	NC (northern district)	Total
1940	4	0	0	264	0	1	0	269
1941	-	-	-	-	-	0	-	-
1942	0	0	0	61	0	0	-	61
1943	0	0	0	8	*	-	-	8
1944	12	0	0	8	2	1	-	23
1945	25	0	0	12	1	1	0	39
1946	34	1	25	69	-	*	-	129
1947	24	1	57	85	24	*	-	191
1948	114	3	63	255	24	5	-	464
1949	91	15	17	415	22	1	-	561
1950	433	91	20	475	50	20	0	1,089
1951	513	206	59	203	44	7	0	1,032
1952	446	203	99	171	41	4	0	964
1953	960	295	53	96	34	1	0	1,439
1954	853	483	15	181	48	1	0	1,581
1955	873	536	30	140	47	3	0	1,629
1956	380	224	1	79	22	2	0	708
1957	109	65	0	56	19	4	0	253
1958	496	97	0	40	37	1	0	671
1959	179	152	0	30	12	7	0	380
1960	541	462	0	35	20	5	0	1,063
1961	162	129	*	46	37	13	0	387
1962	28	31	0	58	43	12	*	172
1963	42	46	0	13	14	6	*	121
1964	102	424	*	37	30	1	0	594
1965	106	478	0	20	8	2	0	614
1966	13	366	1	55	3	*	0	438
1967	2	27	0	8	8	5	0	50
1968	1	23	0	3	3	*	0	30
1969	2	13	0	5	10	*	0	30
1970	8	36	0	3	10	1	0	58
1971	*	21	0	25	15	1	0	62
1972	2	3	0	5	111	*	0	121
1973	51	17	0	3	322	*	0	393
1974	162	21	0	22	380	0	0	585
1975	174	101	0	2	434	0	0	711
1976	212	56	-	25	783	0	0	1,076
1977	63	354	-	314	1,330	0	0	2,061
1978	95	292	-	969	2,048	*	8	3,412
1979	22	433	-	1,253	2,131	*	1	3,840

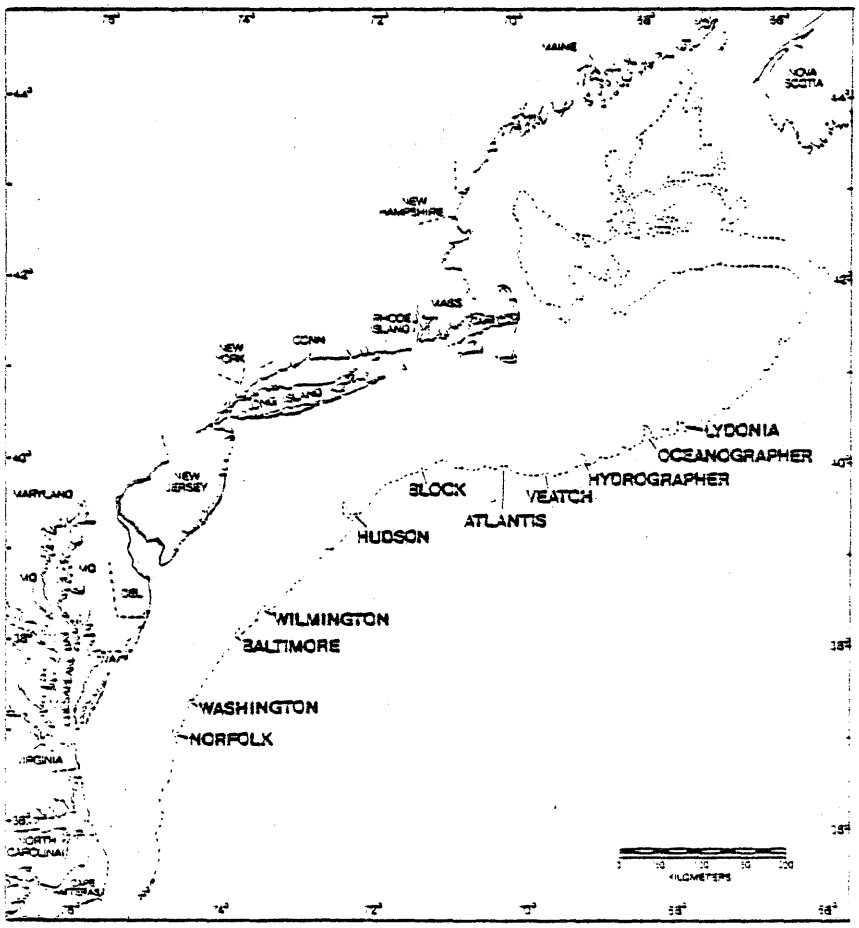

Figure 1. Northwest Atlantic continental shelf between Canada and North Carolina indicating areas and primary submarine canyons referred to in the text.

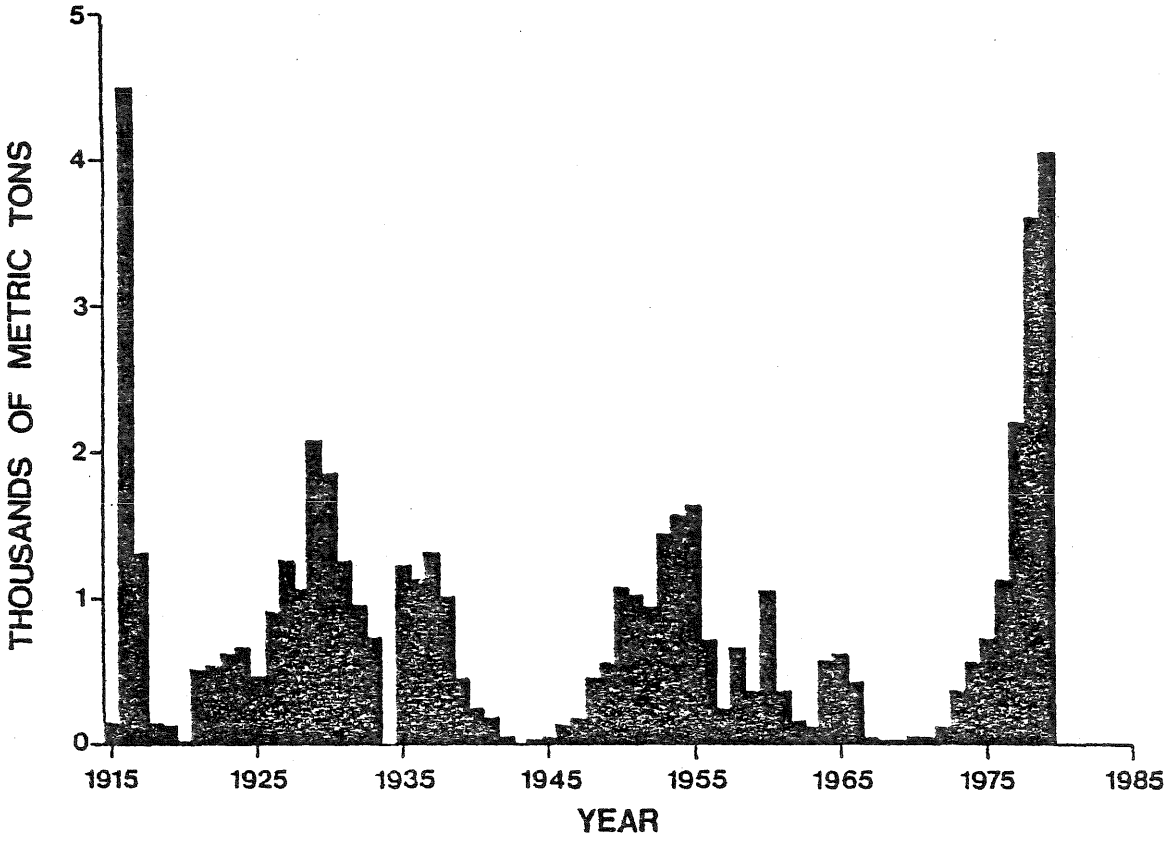

Figure 2. Reported commercial catch of tilefish in the Southern New England-Middle Atlantic area between 1915 and 1979.

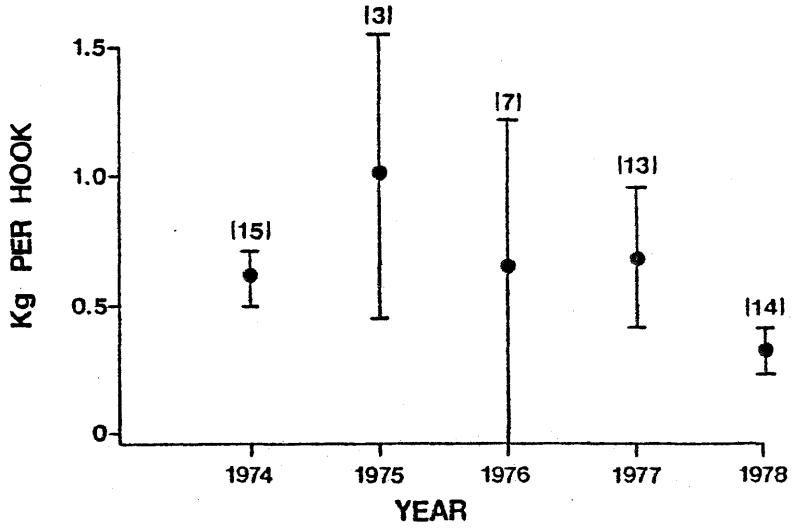

Figure 3. Tilefish longline catch per unit effort (CPUE) in the Southern New England-Middle Atlantic area between 1974 and 1978 (Grimes et al. in press). Number in parentheses, dot, and vertical line indicate sample size (number of fishing trips), mean CPUE, and ± one standard deviation, respectively, for each year.

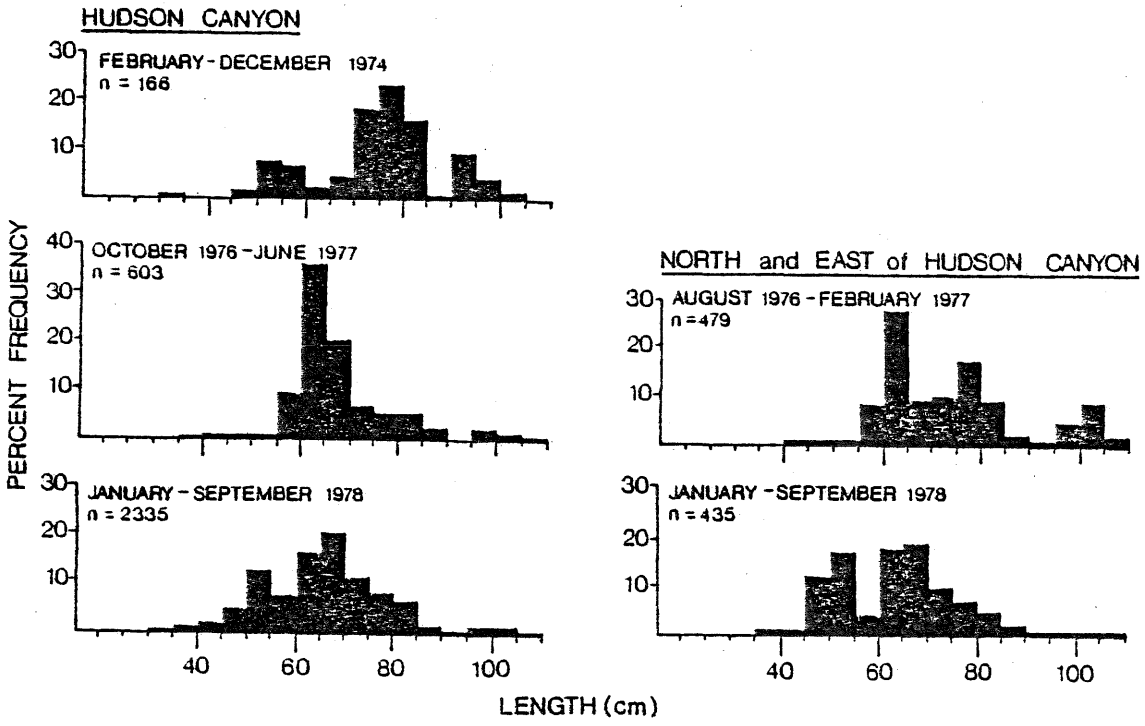

Figure 4. Length frequencies of tilefish caught by longline from Hudson Canyon and other fishing areas north and east of Hudson Canyon (Grimes et al. in press).